

## INFORMAL PRESENTATION OF SHOREBIRD COUNT DATA FROM THE REDWOOD CITY SALT PLANT

**DATA SOURCES:** I worked with several sources of data from the Redwood City Salt Plant (RCSP) to determine which species were found in the plant and their approximate abundances. The sources were: 1) aerial surveys from February 1981 – July 1983 done by California Department of Fish and Game; 2) four high-tide ground surveys, part of the comprehensive shorebird surveys of San Francisco Bay organized by PRBO in January 1990, and November of 1990-92, done with access to levees inside the salt plant; 3) three high-tide ground surveys, part of the comprehensive shorebird surveys of San Francisco Bay organized by PRBO, SFBBO, USFWS, and in November 2006-2008, done from the periphery of the salt plant; and 4) ground surveys done by Matt Leddy from December 2009 – February 2010 and November 2010 – February 2011 from the periphery of the salt plant, similar to the 2006-08 surveys. Pond 10 is not included in the totals reported from the aerial surveys but is included in the 1990-92, 2006-08, and 2009-11 ground surveys; totals for Pond 10 are available separately for the 1990-92, 2006, and 2009-11 surveys but not for 2007 and 2008. In this summary, count totals are reported to 3 significant figures.

most reliable with  
free access

The most reliable data were the four ground surveys from 1990-92, as tidal conditions were standardized for these counts, they were done from the ground, and observers were able to view all ponds well by driving levees within the plant. The aerial surveys were also able to obtain comprehensive views of the pond complex, but counting and species identification problems often arise with aerial surveys. For example, counts may be biased low because the plane often flushes some shorebird species before observers can count them. Further, it is not usually possible to separately identify species in the short time they can be seen from the plane, so combined counts often must be made of similarly-sized species. Information on tidal condition during the aerial surveys are not available. The ground surveys done from the periphery of the ponds differ from those done from within the pond complex in that views of the ponds are frequently not complete, so numbers of birds viewed and counted are always a minimum of those present on the ponds; in addition, some ponds in the complex cannot be viewed at all from the periphery. Also, birds observed on surveys done from the periphery of the ponds are often too distant to identify to species. Tidal conditions in 2006-08 were high and Matt Leddy provided start times so that I could select similarly high tides from his surveys.

**DEFINITIONS:** For comparative purposes between the three time periods for which there are data (1981-83, 1990-92, and 2006-2011), I have mostly used early winter (November and December) and late winter (January and February) surveys. In describing general abundances, low refers to 1-4, mid to 4-7 and high to 7-10. Therefore, high hundreds are 700-999, low thousands 1000-3999, mid thousands 4000-6999, high thousands 7000-9999, and low ten-thousands 10,000-39,999. Species codes are: AMAV American Avocet, BBPL Black-bellied Plover, BNST Black-necked Stilt, DOWI dowitchers, MAGO Marbled Godwit, SEPL Semipalmated Plover, WILL Willet, and WLDU combined Western Sandpiper, Least Sandpiper, and Dunlin.

Nov  
1981:  
Entire complex  
Highest \*

**COMPREHENSIVE SURVEYS OF THE RCSP POND COMPLEX:** The highest number of shorebirds reported for the entire complex, excluding Pond 10, was 35,400 in November 1981; approximately half were in crystallizer ponds 1-9 and three-quarters were Calidris spp. (Western Sandpiper, Least Sandpiper, and Dunlin). The second highest count was 22,700 in November 1992; approximately two-thirds were in crystallizer ponds 1-9 and > 80% were Calidris spp. The median number of shorebirds for the five early winter aerial surveys done in 1981-83 was 9500 (970-35,400) and the median number of shorebirds for the

= 35,400  
[Calidris]

(\* not  
Pond 10)

Nov 1981 = 35,400  
Nov 1992 = 22,700

five late winter surveys was 8320 (3480-10,500). In comparison, the median number of shorebirds for the three November comprehensive ground surveys done in 1990-92 (excluding Pond 10) was 14,500 (6730-22,700) and the corresponding total for January 1990 was 7980. The median number of shorebirds for the 1990-92 ground surveys, including Pond 10, was 16,400 (9610-24,800) in November and 16,200 in January.

1990.  
median  
16,400

The species identified in the RCSP pond complex, the highest numbers (two to three if > 10) reported from these data sources, and the month and year of the maximum counts (in parentheses if from an incomplete count of the plant) were:

Black-bellied Plover	1900	11/1992	1330	11/1991	744	11/1990
Semipalmated Plover	500	(12/2010)	435	(11/2007)	200	(11/2010)
Killdeer	11	(11/2006)				
Black-necked Stilt	1390	12/1981	670	01/1983	630	01/1990
American Avocet	3800	02/1983	2450	01/1982	1500	11&12/1981
Greater Yellowlegs	27	01/1990	11	11/1992		
Lesser Yellowlegs	5	01/1990				
Willet	2420	01/1990	2300	(01/2010)	2000	(two dates)
Whimbrel	13	(11/2006)				
Long-billed Curlew	108	(11/2006)				
Marbled Godwit	2200	10/1982	1000	02/1983	950	(02/2011)
Sanderling	1	11/1990				
Western Sandpiper *	4270	11/1992	2960	11/1990		
Least Sandpiper *	1080	11/1991	429	11/1992		
Dunlin*	14000	11/1992	10100	11/1990		
2 sandpiper + 1 Dunlin Combined Calidris spp. \$	27300	11/1981	18700	11/1992	13100	11/1990
Dowitchers *	1470	(04/2011)	750	01/1990	680	(04/2011)
Wilson's Phalarope	300	06/1982				
Combined Phalarope species *	650	10/1982	300	06/1982	150	08/1992

\*most not identified to species

\$-Western Sandpiper, Least Sandpiper, and Dunlin

Most, if not all, dowitchers could not be identified to species on surveys, although both species probably occurred over the periods the birds were counted. Wilson's Phalaropes were identified on a June survey, when the other species would not have occurred. Wilson's Phalaropes are early migrants and usually move through the San Francisco Bay area between June and August, so that the phalaropes found in October 1982 were most likely Red-necked Phalaropes. Red Phalaropes, the most pelagic of the three species, are relatively uncommon in the San Francisco Bay area.

Wilson's Phalaropes

In summary, comprehensive shorebird counts for the RCSP ponds were obtained only from the aerial surveys and the ground surveys in which internal RCSP access was granted to the ponds. From those surveys at least 17-19 species of shorebirds were detected. In the 1981-83 aerial surveys, all-species totals were highly variable (high hundreds to low ten-thousands) in early winter and usually were in the high thousands in late winter. Both early and late winter all-species totals counted on ground surveys 1990-92 were mostly in the low ten-thousands.

17-19 species

**PERSPECTIVE ON MORE RECENT (SINCE 2006) PARTIAL SURVEYS DONE FROM THE PERIPHERY OF THE RCSP:** Data collected since 2006 have been limited to the few ponds that can be viewed or partially viewed

from outside the plant. For Pond 10, east of the crystallizers, all-species totals were generally lower in 2006 and 2009-11 than in 1990-92, although mostly of the same order of magnitude (low thousands). Below is a summary of counts or median counts for selected species, species groups, and total shorebirds:

Pond 10?

YEAR	MONTHS	N	BNST	AMAV	WILL	MAGO	WLDU	DOWI	ALL SPECIES MEDIAN (MIN-MAX)
<b>EARLY WINTER</b>									
1990-92	Nov	3	0	59	1390	570	10	280	2118 (1920-2870)
2006	Nov	1	6	0	0	0	206	1	239
2009	Dec	1	0	80	1000	50	0	0	1130
2010	NovDec	4	95	150	910	305	0	0	1600 (880-1955)
<b>LATE WINTER</b>									
1990	Jan	1	0	230	1970	280	0	750	3230
2010	JanFeb	7	20	230	1250	300	0	47	1970 (1880-3010)
2011	JanFeb	2	87	333	865	825	1950	97	4160 (2330-5980)

Done from periphery

Interpreting this change is complicated because Pond 10 appears to be considerably smaller in the 2006-11 period than it was in 1990-92. In 1990-92, the eastern portion of Pond 10 bordered Westpoint Slough in an area than now appears to have been developed into a small boat harbor.

Limited data from Crystallizer Pond 1 suggests that 1990-92 numbers were quite variable and surveys done from the periphery (and therefore potential only partial for the pond) in early winter 2010 were within the range of data collected in the earlier period. Species composition in this pond was also quite variable. Count totals for selected species and all species combined are shown below.

Pond 1?

DATE	BBPL	SEPL	BNST	AMAV	WILL	WLDU	DOWI	ALL SPP
11/2/1990	482	0	59	349	154	12722	20	13796
11/20/1991	0	0	28	0	0	0	0	28
11/9/1992	0	0	0	0	0	700	595	1300
11/27/2010	0	200	0	0	0	1900	0	2100
12/04/2010	0	500	0	0	0	1200	78	1778
12/16/2010	0	0	0	0	0	70	0	70
12/17/2010	0	0	0	0	0	0	0	40

14,000

Although comparison of these two ponds is difficult due to the limited number of surveys, a change in access for observers, and a change in the size of one of the ponds, the data available suggest that current overall numbers are in the same order of magnitude as in the 1990-92 period. Data from other ponds in the system could be combined in a similar way for additional comparisons.

Lynne Stenzel July 2011

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	Cargill	PRBO (H2O)	Areacode= H Sitecode = 20
Crystallizer	1	A	
Crystallizer	2	B	
Crystallizer	3	C	
Crystallizer	4	D	
	10	E	only south part in 2006-2008
		F	no current designation, not pond?
Crystallizer	5	G	
Crystallizer	6	H	
Crystallizer	7	I	
Crystallizer	8	J	
Crystallizer	9	K	
	8W	L	
	7A	M	
	7C	N	
	7B	O	
	9	P	
	8E	Q	
	9A	R	
		X	Nov 1991, have to check hard copies to identify
		+	Nov 1992, have to check hard copies to identify

both #9

SSN	POND
BBPL	Black-bellied Plover
SEPL	Semipamlated Plover
KILL	Killdeer
BNST	Black-necked Stilt
AMAV	American Avocet
GRYE	Greater Yellowlegs
LEYE	Lesser Yellowlegs
WILL	Willet
WHIM	Whimbrel
LBCU	Long-billed Curlew
MAGO	Marbled Godwit
SAND	Sanderling
WESA	Western Sandpiper
LESA	Least Sandpiper
DUNL	Dunlin
XWDU	unidentified, either Western Sandpiper or Dunlin
XWLD	unidentified, either Western Sandpiper, Least Sandpiper, or Dunlin
WLDU	combined Western Sandpiper, Least Sandpiper, Dunlin
DOWI	dowitchers spp.

L90	A
L90	B
L90	E
L90	F
L90	M
L90	N
L90	P

	Time	Tide	10	CRY1	CRY2	8W	7B	7C
12/22/2009		4.0 1551	x					
1/1/2010		7.1 1103	x					
1/11/2010		6.5 0811	x			x	x	
1/15/2010		6.1 1055	x					
1/23/2010		low all day	x					
1/30/2010		6.9 1057	x					
2/7/2010		6.0 0551	x					x
2/14/2010		5.5 1119	x				x	x
2/16/2010		4.9 1234		x	x			
3/11/2010		5.3 0818	x				x	x
4/6/2010		low all day	x				x	x
11/27/2010		5.1 1503	x	x				
12/4/2010		7.0 0930		x				
12/16/2010		5.8 0714	x	x	x			
12/17/2010		6.1 0753		x	x			
12/19/2010		6.5 0913			x			
12/20/2010		6.6 0954	x		x		x	
12/21/2010		6.7 1036			x			
12/23/2010		6.4 1205	x		x			
1/18/2011		6.7 0938	x					
2/13/2011		5.9 0636	x					
2/17/2011		6.5 1015	x					
2/18/2011		6.3 1106	x		x		x	x

PRBO data?

SSN	POND	BBPL	SEPL	KILL	BNST	AMAV	GRYE	LEYE	WILL	WHIM	LBCU	MAGO	SAND	WESA	LESA	DUNL	XWDU
E90	A 1	482	0	6	59	349	0	0	154	0	0	4	0	2949	0	9773	0
E90	E 10	0	0	0	0	59	0	0	1000	0	0	570	0	0	0	10	0
E90	L 8W	19	0	0	27	1	0	0	0	0	0	0	0	0	4	2	0
E90	M 7A	243	0	0	0	0	0	0	0	0	0	0	0	15	10	350	0
		744	0	6	86	409	0	0	1154	0	0	574	0	2964	14	10135	0
E91	A 1	0	0	0	28	0	0	0	0	0	0	0	0	0	0	0	0
E91	C 3	0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E91	E 10	0	0	0	0	427	0	0	1390	1	0	625	0	0	0	50	0
E91	G 5	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
E91	I 7	0	0	0	0	0	0	0	0	0	0	0	0	0	335	0	3500
E91	J 8	1335	0	0	0	0	0	0	0	0	0	0	0	0	40	450	0
E91	K 9 2	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0
E91	L 8W	0	0	0	0	0	0	0	0	0	0	0	0	0	215	0	0
E91	N 7C	0	0	0	7	260	0	0	0	0	0	0	0	0	0	0	0
E91	Q	0	0	0	0	0	0	0	0	0	0	0	0	0	245	0	0
E91	X	0	0	0	1	0	1	0	0	0	0	0	0	1	235	0	0
		1335	24	0	38	687	1	0	1390	1	0	625	0	1	1080	500	3500
E92	+	0	0	2	5	0	0	0	0	0	0	0	0	0	123	0	0
E92	A 1	0	0	5	0	0	0	0	0	0	0	0	0	400	0	300	0
E92	E 10	0	0	0	0	0	0	0	1630	1	2	485	0	0	0	0	0
E92	I 7	398	0	0	0	0	0	0	0	0	0	0	1	2000	0	200	0
E92	J 8	1298	0	0	95	165	0	0	157	0	0	0	0	404	7	7671	0
E92	K	0	0	0	142	744	11	0	61	0	0	0	0	0	12	0	0
E92	L 8W	0	1	0	2	0	0	0	0	0	0	0	0	3	22	0	0
E92	M 7A	205	0	0	0	0	0	0	0	0	0	0	0	1460	0	5840	0
E92	P 9 2	0	0	0	0	24	0	0	0	0	0	0	0	0	0	0	0
E92	Q	0	0	0	0	0	0	0	0	0	0	0	0	4	265	0	0
		1901	1	7	244	933	11	0	1848	1	2	485	1	4271	429	14011	0
L90	A 1	0	0	0	630	850	6	0	0	0	0	0	0	30	0	570	0
L90	B	0	0	0	0	0	21	5	2	0	0	0	0	0	0	0	5000
L90	E 10	0	0	0	0	230	0	0	1970	0	0	280	0	0	0	0	5000
L90	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
L90	M 7A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
L90	N 7C	0	0	0	0	20	0	0	450	0	0	0	0	0	0	0	0
L90	P 9 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E90 = Nov 1990																	
E91 = Nov 1991																	
E92 = Nov 1992																	
L90 = Jan 1990																	

\* See EXCEL TABLE TAB for Legend

XWLD	WLDU	DOWI	Total	% ABELN	AREACODE	SITECODE	DATE	SPNAME
0	12722	20	13796		H	20A	11/2/1990	AMERICAN AVOCET
0	10	280	1919		H	20E	11/2/1990	AMERICAN AVOCET
0	6	2	55		H	20L	11/2/1990	AMERICAN AVOCET
0	375	28	646		H	20M	11/2/1990	BLACK-BELLIED PLOVER
0	13113	330	16416	0.960648				
			14497	- Pond 10				
0	0	0	28		H	20A	11/20/1991	BLACK-NECKED STILT
0	0	0	24		H	20C	11/20/1991	SEMIPALMATED PLOVER
0	50	380	2873		H	20E	11/20/1991	AMERICAN AVOCET
0	0	0	2		H	20G	11/20/1991	BLACK-NECKED STILT
0	3835	0	3835		H	20I	11/20/1991	LEAST SANDPIPER
0	490	1	1826		H	20J	11/20/1991	BLACK-BELLIED PLOVER
0	10	0	10		H	20K	11/20/1991	LEAST SANDPIPER
0	215	0	215		H	20L	11/20/1991	LEAST SANDPIPER
0	0	0	267		H	20N	11/20/1991	AMERICAN AVOCET
0	245	0	245		H	20Q	11/20/1991	LEAST SANDPIPER
0	236	45	283		H	20X	11/20/1991	BLACK-NECKED STILT
0	5081	426	9608	0.352102				
			6735	- Pond 10				
0	123	20	150		H	20+	11/9/1992	BLACK-NECKED STILT
0	700	595	1300		H	20A	11/9/1992	DOWITCHER SPP.
0	0	0	2118		H	20E	11/9/1992	LONG-BILLED CURLEW
0	2200	5	2604		H	20I	11/9/1992	BLACK-BELLIED PLOVER
0	8082	31	9828		H	20J	11/9/1992	AMERICAN AVOCET
0	12	0	970	16820	H	20K	11/9/1992	AMERICAN AVOCET
0	25	0	28		H	20L	11/9/1992	BLACK-NECKED STILT
0	7300	0	7505		H	20M	11/9/1992	BLACK-BELLIED PLOVER
0	0	0	24		H	20P	11/9/1992	AMERICAN AVOCET
0	269	0	269		H	20Q	11/9/1992	LEAST SANDPIPER
0	18711	651	24796	0.138974				
			22678	- Pond 10				
				0.648294	0.825073			
0	600	0	2086		H	20A	1/26/1990	AMERICAN AVOCET
0	5000	0	5028		H	20B	1/26/1990	GREATER YELLOWLEGS
0	5000	750	8230		H	20E	1/26/1990	AMERICAN AVOCET
250	250	0	250		H	20F	1/26/1990	LEAST/WESTERN/DUNLIN
100	100	0	100		H	20M	1/26/1990	LEAST/WESTERN/DUNLIN
0	0	0	470		H	20N	1/26/1990	AMERICAN AVOCET
50	50	0	50		H	20P	1/26/1990	LEAST/WESTERN/DUNLIN

XWLD	WLDU	DOWI	Total	% ABELN	AREACODE	SITECODE	DATE	SPNAME
0	12722	20	13796		H	20A	11/2/1990	AMERICAN AVOCET
0	10	280	1919		H	20E	11/2/1990	AMERICAN AVOCET
0	6	2	55		H	20L	11/2/1990	AMERICAN AVOCET
0	375	28	646		H	20M	11/2/1990	BLACK-BELLIED PLOVER
0	13113	330	16416	0.960648				
			14497	- Pond 10				
0	0	0	28		H	20A	11/20/1991	BLACK-NECKED STILT
0	0	0	24		H	20C	11/20/1991	SEMIPALMATED PLOVER
0	50	380	2873		H	20E	11/20/1991	AMERICAN AVOCET
0	0	0	2		H	20G	11/20/1991	BLACK-NECKED STILT
0	3835	0	3835		H	20I	11/20/1991	LEAST SANDPIPER
0	490	1	1826		H	20J	11/20/1991	BLACK-BELLIED PLOVER
0	10	0	10		H	20K	11/20/1991	LEAST SANDPIPER
0	215	0	215		H	20L	11/20/1991	LEAST SANDPIPER
0	0	0	267		H	20N	11/20/1991	AMERICAN AVOCET
0	245	0	245		H	20Q	11/20/1991	LEAST SANDPIPER
0	236	45	283		H	20X	11/20/1991	BLACK-NECKED STILT
0	5081	426	9608	0.352102				
			6735	- Pond 10				
0	123	20	150		H	20+	11/9/1992	BLACK-NECKED STILT
0	700	595	1300		H	20A	11/9/1992	DOWITCHER SPP.
0	0	0	2118		H	20E	11/9/1992	LONG-BILLED CURLEW
0	2200	5	2604		H	20I	11/9/1992	BLACK-BELLIED PLOVER
0	8082	31	9828		H	20J	11/9/1992	AMERICAN AVOCET
0	12	0	970	16820	H	20K	11/9/1992	AMERICAN AVOCET
0	25	0	28		H	20L	11/9/1992	BLACK-NECKED STILT
0	7300	0	7505		H	20M	11/9/1992	BLACK-BELLIED PLOVER
0	0	0	24		H	20P	11/9/1992	AMERICAN AVOCET
0	269	0	269		H	20Q	11/9/1992	LEAST SANDPIPER
0	18711	651	24796	0.138974				
			22678	- Pond 10				
				0.648294	0.825073			
0	600	0	2086		H	20A	1/26/1990	AMERICAN AVOCET
0	5000	0	5028		H	20B	1/26/1990	GREATER YELLOWLEGS
0	5000	750	8230		H	20E	1/26/1990	AMERICAN AVOCET
250	250	0	250		H	20F	1/26/1990	LEAST/WESTERN/DUNLIN
100	100	0	100		H	20M	1/26/1990	LEAST/WESTERN/DUNLIN
0	0	0	470		H	20N	1/26/1990	AMERICAN AVOCET
50	50	0	50		H	20P	1/26/1990	LEAST/WESTERN/DUNLIN

H20

